IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application. No: 10/051,442	§	Atty. Dkt. No: 5150-58200
Filed: January 18, 2002	§	
Inventor(s): Sundeep Chandhoke, Nicolas Vazquez, David W Fuller, and Christopher Cifra	§	
Title: System and Method for Graphically Creating a Sequence of Motion Control, Machine Vision, and Data Acquisition (DAQ) Operations	§	
Examiner: Hanne, Sara M.	§	
Group/Art Unit: 2179	§	

REPLY BRIEF

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Dear Sir/Madam:

In response to the Appeal Brief filed December 17, 2007 and the Examiner's Answer mailed January 25, 2008, Appellant presents this Reply Brief. Appellant respectfully requests that this Reply Brief be considered by the Board of Patent Appeals and Interferences.

REMARKS

Claim 53

With respect to the 102(e) rejection in view of Blowers, Appellant re-asserts in full the arguments set forth in the Appeal Brief and presents additional remarks in response to the Examiner's arguments presented in the Examiner's Answer.

Throughout prosecution of the present patent application, the Examiner had interpreted the camera taught by Blowers as the DAQ measurement device recited in the present claims, and interpreted the Caliper tool operation taught by Blowers as the DAQ operation recited in the claims. Appellant respectfully submits that in the Appeal Brief, Appellant successfully argued against this interpretation of the DAQ measurement device as a camera, noting that claim 53 for example recites in pertinent part, "wherein at least one of the DAQ operations included in the sequence is operable to control a DAQ measurement device to acquire measurement data of a device under test." As argued in the Appeal Brief, the Caliper tool (which the Examiner has interpreted as the DAQ operation) is not operable to control the camera. In particular, the Caliper tool is not operable to control the camera to acquire measurement data of a device under test. The Caliper tool is software that analyzes an image and measures aspects of the image. It is improper to interpret this as a DAQ operation that controls a DAQ measurement device to acquire measurement data of a device under test for at least the reasons that: 1) the image which the Caliper tool analyzes is not itself a device under test; and 2) the Caliper tool does not control the camera at all, much less control the camera to acquire data from a device under test. Thus, Appellant continues to disagree with the interpretation of the DAQ measurement device as a camera. (Appellant disagrees with this interpretation not only for the reasons stated above, but also for the additional reasons set forth in the Appeal Brief.)

In the Response to Arguments section of the Examiner's Answer, the Examiner gives an alternative interpretation of the DAQ measurement device as follows:

> Under the lattermost interpretation, the computer itself is the DAQ measurement devices providing machine vision and data acquisitions operations (Col. 8, lines 9-1 9), the user's inputs create a sequence through the computer (Col. 3, lines 20-45) and the sequence controls the device to acquire the measurement data (Col. 11, line 65 et seq. and Caliper tool 63) of the device under test (computer sensor for Caliper tool 63).

However, Appellant argues that this interpretation is also improper, and that even under this interpretation, Blowers still fails to teach the combination of limitations recited in claim 53.

First, Appellant again points out the particular language of the claim, which recites, "wherein at least one of the DAQ operations included in the sequence is operable to control a DAQ measurement device to acquire measurement data of a device under test." In contrast, the Caliper tool software to which the Examiner refers operates to analyze an image and measure aspects of the image. Measuring aspects of an image that has been acquired is not at all the same as acquiring measurement data of a device under test itself.

Appellant notes that claims must be given the broadest reasonable interpretation consistent with the specification. The broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach. (See MPEP 2111). As well known to those skilled in the art, a DAQ measurement device operates to acquire measurement data from an actual device under test through physical means. See, for example, FIGs. 2A and 2B of the present application, which illustrate plug-in data acquisition boards 114 which operate through signal conditioning hardware 124 to acquire measurement data from the physical unit under test or physical system 150. See also, for example, the specification, which states that:

> For the DAQ operations in the sequence, the computer system may interface with a DAQ device coupled to the computer system to perform the DAQ operations configured by the user. For example, a DAQ operation may command the DAQ device to acquire data from an analog input channel or may cause signal conditioning to be performed on such data. (*p. 6, lines 21-25*)
>
> The sequence developed in the prototyping environment described herein may include one or more DAQ operations. Thus, when the host computer 82 executes the sequence, the DAQ operations may control the DAQ board 114, e.g., to cause the DAQ board 114 to acquire data from the UUT. (*p. 17, lines 5-8*)

Thus, Appellant respectfully submits that it is clear to those skilled in the art, particularly in light of the drawings and specification, that acquiring measurement data of a device under test means that the measurement data is acquired from the device under test itself, not from an image of the device under test.

It is also clear to those skilled in the art that the DAQ measurement device should not be interpreted as the host computer that executes the sequence, but instead is a separate device from the host computer. Appellant notes that the Examiner's interpretation of the DAQ measurement device as the host computer appears to violate the definitions of data acquisition given by the Examiner in the Examiner's Answer. For example, as noted by the Examiner, the Windmill Software Ltd. reference defines data acquisition as, "The automatic collection of data <u>from sensors, instruments and devices</u>: in a factory, laboratory or in the filed." This clearly refers to the acquisition of data through physical sensors, instruments, and devices – not to analyzing an image. This type of data acquisition also clearly requires some other device than just the host computer, i.e., requires a device that actually acquires the data.

As for the Softmap Inc reference, as noted by the Examiner, it teaches that, "SMDigCam real-time data acquisition software provides you with the capability to acquire images in a real-time environment <u>including control of all the camera operation aspects</u>." However, as discussed above, Blowers' Caliper tool software, which the Examiner cites as the DAQ operation which controls the DAQ measurement device to acquire the measurement data, does <u>not</u> control the camera in any way. Instead, the Caliper tool simply analyzes an image which has already been acquired by a camera. Applicant thus respectfully submits that both of the definitions cited by the Examiner support Appellant's arguments that the Caliper tool operating to analyze an image should not be interpreted as a DAQ operation that controls a DAQ measurement device to acquire measurement data of a device under test.

Furthermore, Appellant respectfully submits that in light of Appellant's specification, those skilled in the art would interpret the Caliper tool operation and other image operations taught by Blowers as <u>machine vision</u> operations rather than DAQ operations. Throughout the entire specification, reference is made to three different types of operations: motion control operations, machine vision operations, and data acquisition (DAQ) operations. Appellant notes that claim 53 recites <u>both</u> machine vision operations <u>and</u> DAQ operations. With respect to machine vision operations, the specification describes that:

> Any of various types of <u>machine vision or image analysis operations</u> may also be provided. Exemplary functions related to machine vision and image analysis include:
>
> · <u>filtering functions for smoothing, edge detection, convolution, etc</u>.
>
> · morphology functions for modifying the shape of objects in an image, including erosion, dilation, opening, closing, etc.
>
> · thresholding functions for selecting ranges of pixel values in grayscale and color images
>
> · particle filtering functions to filter objects based on shape measurements
>
> · a histogram function that counts the total number of pixels in each grayscale value and graphs it
>
> · a line profile function that returns the grayscale values of the pixels along a line drawn through the image with a line tool and graphs the values
>
> · particle analysis functions that computes such measurements on objects in an image as their areas and perimeters
>
> · a 3D view function that displays an image using an isometric view in which each pixel from the image source is represented as a column of pixels in the 3D view, where the pixel value corresponds to the altitude.
>
> · <u>an edge detection function that finds edges along a line drawn through the image with a line tool</u>
>
> · a pattern matching function that locates regions of a grayscale image that match a predetermined template
>
> · a shape matching function that searches for the presence of a shape in a binary image and specifies the location of each matching shape
>
> · <u>a **caliper function** that computes measurements such as distances, areas, and angles based on results returned from other image processing functions</u>
>
> · a color matching function that quantifies which colors and how much of each color exist in a region of an image and uses this information to check if another image contains the same colors in the same ratio (*p. 22, line 9 – p. 23, line 5, emphasis added*)

Thus, Appellant's specification discloses <u>machine vision</u> operations, including "filtering functions for smoothing, edge detection, convolution, etc." and "an edge detection function that finds edges along a line drawn through the image with a line tool" and "a <u>**caliper function**</u> that computes measurements such as distances, areas, and angles based on results returned from other image processing functions." Appellant notes that these machine vision operations perform functions very similar to Blowers' Caliper tool. Blowers describes that, "The caliper tool 63 is used to locate pairs of edges within an inspection image. A Region Of Interest (ROI) defines the area to be searched within the image and also the orientation of the edge pairs. The caliper tool 63 is typically used to measure component width by finding edges with sharp contrast changes. The caliper tool

63 generates pass/fail results based on its ability to find edge pairs that are within the specified image." (Col. 9, lines 44-52).

In contrast, the specification describes DAQ operations as follows:

> Any of various types of DAQ operations may also be provided. For example, the DAQ operations may include operations related to digital I/O, analog input, analog output, signal conditioning, calibration and configuration (e.g., to calibrate and configure specific devices), counting operations, etc. (*p. 22, lines 5-8)*

Appellant notes that claim 53 recites, "wherein the plurality of operations included in the sequence includes at least one <u>machine vision operation</u> and at least one <u>DAQ operation,</u>" thus drawing a distinction between machine vision operations and DAQ operations. In light of the specification, which clearly describes machine vision operations that are very similar to Blowers' Caliper tool, **those skilled in the art would interpret Blower's Caliper tool and other image functions not as DAQ operations, but as machine vision operations**. Appellant respectfully submits that Blowers' Caliper tool and other image functions are clearly machine vision operations. The Examiner's interpretation of these functions as DAQ operations instead of machine vision operations simply represents an attempt to reject the claims without any regard as to how those skilled in the art would interpret the claim terms in light of Appellant's specification.

Furthermore, Appellant notes that claim 57 depends on claim 53 and recites:

> wherein the prototype is operable to:
> acquire one or more images of the device under test;
> analyze the acquired images of the device under test; and
> acquire the measurement data of the device under test.

Thus, acquiring the measurement data of the device under test is recited separately from acquiring one or more images of the device under test and analyzing the acquired images of the device under test. Appellant submits that this claim makes it very clear that acquiring the measurement data of the device under test should be interpreted as something other than acquiring images of the device under test and something other than analyzing the acquired images. Blowers does not teach: 1) acquire one or more images of the device

under test; 2) analyze the acquired images of the device under test; **and** 3) acquire the measurement data of the device under test.

Applicant thus respectfully submits that claim 53 is patentably distinct over Blowers. Inasmuch as the other independent claims also recite limitations similar to those discussed above with reference to claim 53, and inasmuch as the Examiner relies on Blowers to teach these limitations, Appellant respectfully submits that the other independent claims are also patentably distinct over the cited art, as well as for the additional reasons set forth in the Appeal Brief with respect to the other independent claims.

Claims 57 and 58

Appellant notes that the Examiner's Answer does not address the arguments given with respect to claims 57 and 58. As noted previously, claim 58 recites both controlling an image acquisition device to acquire one or more images of the device under test and controlling the DAQ measurement device to acquire the measurement data of the device under test. Measuring visual features in an acquired image as taught by Blowers is not at all the same as controlling a DAQ measurement device to acquire measurement data of a device under test, as recited in claim 58. As well known to those skilled in the art of test and measurement applications (particularly in light of Applicant's specification as discussed above with respect to claim 53), the DAQ measurement device acquires the measurement data from the device under test itself, not from an image of the device under test. Appellant thus respectfully submits that claim 58 is separately patentable over Blowers.

As per claim 57, as discussed above, Blowers does not teach all three of 1) acquire one or more images of the device under test; 2) analyze the acquired images of the device under test; **and** 3) acquire the measurement data of the device under test. Appellant notes that claim 57 further clarifies that the measurement data is acquired from the device under test itself, not from the acquired images of the device under test. (The step of analyzing specifically recites that the acquired images of the device under test are analyzed, whereas the step of acquiring recites acquiring measurement data of the device under test (not acquiring measurement data of the acquired images of the device under test).

Inasmuch as claims 9 and 42 recite similar limitations as claim 58, Appellant submits that these claims are also patentably distinct over the cited references.

Claim 60

With respect to claim 60, Appellant disagrees with the Examiner's assertion in the Examiner's Answer that, "the user does not specify the nodes themselves in either implementation" [i.e., the claims or Blowers]. The user does in fact specify the nodes themselves in Blowers.

Claim 60 recites:

> automatically generating a graphical program based on the sequence of operations, wherein the graphical program is executable to perform the sequence of operations, wherein the graphical program comprises a plurality of interconnected nodes that visually indicate functionality of the graphical program, wherein automatically generating the graphical program comprises automatically including the plurality of interconnected nodes in the graphical program without user input specifying the nodes.

The Examiner has interpreted Blowers' tree structure shown in FIG. 7 as the recited graphical program and has interpreted the icons illustrated in the tree structure as the plurality of interconnected nodes that visually indicate functionality of the graphical program. However, Blowers clearly teaches that icons are included in the tree structure in response to user input selecting the icons. See Col. 8, lines 61-67, where Blowers teaches that:

> A design engine or task sequencer engine 46 is used to configure and test the flow and design of the application software as illustrated by an exemplary task sequencer list of FIG. 6. Graphical representations or icons are selected from the tool boxes of FIG. 5 which correspond to desired functional tasks and are linked into the tree structure of FIG. 6 by a task sequencer interface 50 in the desired locations.

See also the Abstract, where Blowers teaches:

> Graphical representations of possible hardware and possible machine vision tasks are displayed. Commands are received from a user to select desired hardware operating parameters corresponding to desired hardware and a machine vision graphical representation and its associated first control program corresponding to a desired machine vision task. The tree structure is displayed wherein the selected machine vision graphical representation is a node of the structure and the first control program is linked into the structure.

Thus, the nodes/icons in Blowers' tree view structure (which the Examiner has equated with the nodes recited in claim 60) are **not** automatically included in the tree view structure without user input specifying the nodes/icons, as recited in claim 60. Appellant thus respectfully submits that claim 60 is separately patentable over Blowers.

Inasmuch as claims 24, 52, and 68 recite similar limitations as claim 60, Appellant submits that these claims are also patentably distinct over the cited references.

Section 103 Rejections (Blowers in view of Weinhofer)

Regarding the Section 103(a) rejections over Blowers in view of Weinhofer, Appellant respectfully submits that the Examiner still has not demonstrated why one skilled in the art would be motivated to combine the references. The Examiner cites as evidence of the motivation to combine Weinhofer's teaching at Col. 1, line 48 that:

> Motion controllers may for example be provided in the form of modules for a programmable controller system or as PC-based expansion cards or stand-alone units that communicate with the programmable controller system via a network communication link.

This simply describes a hardware architecture for a motion control system, where the motion controllers are provided in the form of modules for a programmable controller system. Blowers nowhere teaches such a programmable controller system that uses motion controller modules or other modules, and thus, this teaching does not amount to a motivation to combine the references.

Blowers is directed toward developing software for machine vision applications, e.g., for analyzing images. Weinhofer is directed toward developing software for motion control applications, e.g., for controlling the motion of objects. Appellant can find no teaching in Blowers regarding the development of software to perform an application involving motion control operations as taught in Weinhofer nor any teaching regarding a need to perform motion control operations such as taught in Weinhofer. Similarly, Appellant can find no teaching in Weinhofer regarding the development of software to perform an application involving machine vision operations as taught in Blowers nor any teaching regarding a need to perform machine vision operations such as taught in

Blowers. Thus, there is no motivation or suggestion for incorporating the motion control operations taught in Weinhofer into Blowers's system.

Furthermore, Weinhofer actually teaches away from incorporating Weinhofer's motion control operations into Blowers's system, as discussed in the Appeal Brief. Weinhofer describes that existing programming interfaces do not enable the relationship between various motion control axes to be readily ascertained. To solve this problem, Weinhofer teaches at Col. 4, lines 8-20 that:

> Advantageously, the programming interface according to the preferred embodiment of the invention explicitly indicates the physical relationship between the various motion control axes. <u>The various motion control axes are represented by icons, and the icons are connected with connection lines that represent data flow between the motion control axes. Additional icons are provided that show relationships such as gearing, position cams, time cams, and so on.</u> The programming interface is thus organized based on the physical relationship between the axes, and the physical relationships for the entire system are displayed to the user in a single workspace, without the user having to click on numerous icons. (*Emphasis added*)

Thus, Weinhofer clearly teaches that a programming interface which explicitly indicates the physical relationship between the various motion control axes is an important aspect of the invention. The connection lines between the icons represent data flow between the motion control axes.

Blowers simply teaches a system where a user simply selects various operations and arranges them in a sequence. Blowers's system is not related to motion control, and does not use a programming interface which explicitly indicates the physical relationship between various motion control axes, and does not use connection lines that represent data flow between the motion control axes. Appellant thus submits that in light of Weinhofer's teaching, one skilled in the art would not be motivated to use Weinshofer's motion control operations in Blowers' system to create a motion control application since Blowers's system for creating a sequence of operations lacks these fundamental aspects of Weinhofer's system.

<u>Claim 72</u>

The Examiner's Answer does not address the arguments given with respect to claim 72. Appellant submits that claim 72 is separately patentable over the cited references for the reasons set forth in the Appeal Brief.

Claim 15

In the Examiner's Answer, the Examiner states that, "Claim 7 shows a property window, graphics panel that is displayed in accordance with a placed operation." However, the Examiner does not address the arguments set forth in the Appeal Brief. As argued previously, Appellant can find no teaching in Blowers or Weinhofer of automatically displaying a graphical panel for setting properties of an operation in response to including the operation in a sequence. Appellant thus submits that claim 15 is separately patentable over the cited references.

Claim 26

With respect to claim 26, Appellant re-asserts the arguments set forth in the Appeal Brief. The Examiner states that, "The nodes indicate if then else statement which are a visually indication of which way the flow will occur, (fig. 7)". However, an if-then-else statement represents a flow of execution logic, not a flow of data. Appellant discussed at length in the Appeal Brief why Blower's tree structure is not a graphical data flow program and why it does not visually indicate data flow among the nodes in the tree.

Claim 27

Claim 27 recites the additional limitations of, "automatically generating a text-based program based on the sequence of operations, wherein the text-based program is executable to perform the specified sequence of operations, wherein the text-based program comprises a plurality of lines of textual source code, wherein automatically generating the text-based program comprises automatically including the lines of textual source code in the text-based program without user input specifying the lines of textual source code."

The Examiner states that, "The examiner notes that this limitation is explicitly or inherently included in practically every programming language, including COM (Col. 4, lines 40-44) and is the exact reason for Blowers statement Col. 3, lines 64-65."

Appellant strongly disagrees that the limitations recited in claim 27 are explicitly or inherently included in practically every programming language. Furthermore, if the Examiner believes that the prior art teaches the recited limitations then the Examiner should provide some evidence that this is the case. Appellant is not aware of any prior art system that teaches the combination of limitations recited in claim 27.

Blowers merely teaches that the user creates a sequence of operations. Blowers does not teach automatically generating a text-based program based on the sequence of operations, where the text-based program comprises a plurality of lines of textual source code, and where automatically generating the text-based program comprises automatically including the lines of textual source code in the text-based program without user input specifying the lines of textual source code. Appellant respectfully submits that the most likely implementation of Blower's system is that the sequence is simply executed, i.e., without first automatically generating a <u>text-based program comprising lines of textual source code executable to perform the sequence</u>.

<u>Claim 28</u>

With respect to claim 28, Appellant submits that the Examiner's arguments given in the Examiner's Answer do not take the full combination of claim limitations into account and do not overcome the arguments set forth in the Appeal Brief.

<u>Claim 29</u>

With respect to claim 29, Appellant argued in the Appeal Brief that Blowers nowhere teaches anything at all regarding automatically converting the tree structure to a hardware configuration format usable for configuring configurable hardware of an embedded device to perform the sequence of operations or configuring the configurable hardware of the embedded device to perform the sequence of operations using the hardware configuration format. Appellant respectfully submits that the Examiner's arguments given in the Examiner's Answer do not overcome these arguments.

Claims 69, 73, 76, and 78

Appellant re-asserts the arguments given in the Appeal Brief. It is clear from the language of the claim that the "results" which are referred to in claim 69 are actual results of performing the sequence. The icon and name of each step in Blowers simply indicate the functionality performed by the step, they do not visually indicate results of performing the sequence. Blowers does discuss results of the sequence, but these results are generated by actually executing the operations in the sequence, and the operations are executed after the sequence has been created, not while the sequence is being created. See for example, claim 1 of Blowers: "results obtained by execution of the selected first control program".

Claim 71

Appellant re-asserts the arguments given in the Appeal Brief with respect to claim 71 and submits that the Examiner's arguments given in the Examiner's Answer do not overcome these arguments. Appellant respectfully submits that the art does not fairly teach or suggest to one to make the specific combination as claimed in claim 71 and that the Examiner has simply engaged in improper hindsight analysis in the rejection of claim 71.

The Examiner states that:

> FPGA are a standard commonly used implementation in the field of computer programming dating back to the 1980s and it would have been obvious to use program an FPGA in order to implement the sequence in another device. Anyone of ordinary skill in the art knows system designers use FPGAs on a regular basis to implement any programmed function and a widearray of devices.

However, Appellant is not claiming the general use of an FPGA to implement the sequence, but is claiming the specific limitations recited in claim 71. Appellant submits that the prior art does not teach the recited limitation of, "automatically converting the sequence of operations to a hardware configuration format usable for configuring a Field Programmable Gate Array (FPGA) device to perform the sequence of operations".

Section 103 Rejections (Blowers in view of Weinhofer and Wolfson)

Regarding the Section 103(a) rejections over Blowers in view of Weinhofer and Wolfson (claims 21-23, 70, 74-75, 77, and 79-81), Appellant re-asserts the arguments set forth in the Appeal Brief. Wolfson clearly is not analogous art with respect to the present claims, as argued in the Appeal Brief.

With respect to claim 21, the Examiner argues that, "Wolfson is specifically included to show that the generation and display spatial trajectory graph is not new." However, claim 21 does not claim the general concept of the generation and display of a spatial trajectory graph. Instead, claim 21 recites specifically, "displaying a graph illustrating a spatial trajectory cumulatively performed by the two or more motion control operations, wherein the graph provides a visual preview of the spatial trajectory cumulatively performed by the two or more motion control operations." The references, taken either singly or in combination, simply do not teach these features.

Appellant re-asserts in full the arguments previously set forth with respect to claims 21, 22, and 70 in the Appeal Brief. Appellant respectfully submits that the Examiner's Answer does not successfully rebut these arguments.

CONCLUSION

Applicant submits the application is in condition for allowance, and an early notice to that effect is requested.

If any extensions of time (under 37 C.F.R. § 1.136) are necessary to prevent the above-referenced application(s) from becoming abandoned, Applicant(s) hereby petition for such extensions. The Commissioner is hereby authorized to charge any fees which may be required or credit any overpayment to Meyertons, Hood, Kivlin, Kowert & Goetzel P.C., Deposit Account No. 50-1505/5150-58200/JCH.

Respectfully submitted,

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